MYCOTAXON

Volume 108, pp. 159–174 *April–June 2009*

Two intimately co-occurring species of *Mycena* section *Sacchariferae* in south-west Australia

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Abstract—Two diminutive, lignicolous species of *Mycena* section *Sacchariferae* are described from Western Australia: *Mycena judithiana* sp. nov. of stirps *Amparoina*, and *Mycena tenerrima* of stirps *Adscendens*. *M. tenerrima* had been unrecorded in Western Australia and unconfirmed in Australia. Six morphological stages of the diphasic mode of development of *M. judithiana* were characterized by observing a succession of basidiomes produced on incubated fragments of wood from which the fungi were originally collected. A wood fragment from which *M. tenerrima* was originally collected yielded basidiomes of that species for the first 25 days of incubation and then also began to produce basidiomes of *M. judithiana*. This indicates how closely the two species can co-occur in south west Australia and perhaps elsewhere.

Key words—*Agaricales*, *Mycenaceae*, taxonomy

Introduction

Mycenoid fungi with diminutive, pale basidiomes are frequently encountered in eucalypt dominated ecosystems of Australia, including those with a granulose, floccose or pulverulent pileus characteristic of *Mycena* section *Sacchariferae* (Grgurinovic 1997, 2003). The granulose pileal surface consists of acanthocysts and sometimes also cherocytes and has been interpreted as a universal veil (Desjardin 1995). A worldwide account of *Mycena* section *Sacchariferae* by Desjardin (1995) arranged 55 epithets into 27 taxa. Some additional taxa to those in Desjardin's account occur in the Asia-Pacific region, e.g. *Mycena vesiculosa* Maas Geest. & E. Horak in New Guinea (Maas Geesteranus & Horak 1995), and *Mycena cupulicola* Issh. Tanaka in Japan (Tanaka & Hongo 2003). Six species of *Sacchariferae* were included in a treatment of Australian *Mycena* by Grgurinovic (2003). To date only one of the species of *Sacchariferae* has been confirmed in Western Australia—*Mycena carmeliana* Grgur. There it has been

recorded from urban bushlands of Perth, remnant natural bushlands in the Western Australian wheatbelt, and in wet eucalypt forests of the south-west (data from the Western Australian Herbarium specimen database).

In this current paper, two species of section *Sacchariferae* recently discovered in Western Australia are treated—*Mycena judithiana* and *Mycena tenerrima*. *M. tenerrima* occurs throughout the world including the Southern Hemisphere, occurring on various woody substrates including conifers and hardwoods (Desjardin, 1995). Although it had not been known in Western Australia, it has been reported in other parts of Australia since the late 19th century (May & Wood 1997). However, Grgurinovic (1997) examined material labelled as *Mycena tenerrima* deposited at MEL and concluded that Australian records of *M. tenerrima* have a misapplied name. The fungus described as *M. tenerrima* by Cleland (1934) from South Australia refers to *Mycena pitereka* Grgur. and *Mycena minya* Grgur., both of which are morphologically distinct from *M. tenerrima* (Grgurinovic 1997).

During this current study, *M. judithiana* was initially collected at Bold Park, an urban bushland in the inner metropolitan area of Perth. This species was collected again 18 days later about 320 km south at the Leeuwin-Naturaliste National Park near Augusta on the south coast of Western Australia. Also, a collection of *Mycena tenerrima* was obtained about 30 meters away on the same day within the same bushland near Augusta. Immediately after collecting them, fragments of the wood on which each of these three collections of *Mycena* were found were incubated at room temperature in separate humid chambers for a period of four weeks. In each case, the wood yielded many specimens of the particular species that originally had been observed on the respective fragments of wood. However, after 25 days incubation the wood fragments on which *Mycena tenerrima* was fruiting began to also yield basidiomes of *Mycena judithiana*, indicating how closely the two species may co-occur in southwest Australia and perhaps elsewhere.

Description of the species

Mycena judithiana Bougher, **sp. nov.** FIGS 1–3

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PILEUS 1–3 (6) mm diam; tenuiter carnosa, primo hemisphaericus dein late campanulatus vel convexus, granulosus, primo albus maturitate pallide griseus prope centro. LAMELLAE adnexae, primo albae dein cremeae, subdistantae, margine fimbriato dein lucenti. STIPES 5–35 × 0.3–1.0 mm, centralis, solidus, basi non tumidus, granulosus, sine disco basali, albus vel sordide cremeus, siccus, cystidiis numerosis digitiformibus. ODOR nullus. SAPOR mitis. BASIDIOSPORAE (6.9) 7.1–7.8 (7.9) × (6.5) 6.7–7.4 µm, hyalinae, dilute amyloideae, subglobosae vel globosae, laeves. BASIDIA tetraspora, fibulata. PLEUROCYSTIDIA nulla. CHEILOCYSTIDIA 18–32 × 9–19 µm, anguste vel late clavata, pyriformia, sphaeropedunculata, vesiculosa, confertim spinulosa, prope basin laevis, spinulae ad 0.8 µm × 0.3 µm, fibulatae. ACANTHOCYSTAE 15–32 × 9–19 µm, confertim spinulosa, spinulae ad 1.5 × 1 µm, parietibus tenuibus. CHEROCYTAE 9–32 × 9–19 µm, globosae, pyriformes, vesiculosae, irregulares,

FIGURE 1. Mature and primordial basidiomes of *Mycena judithiana* (Holotype). Scale bar = 2 mm.

parietibus crassis (pariete ad 2.4 µm crasso), spinae ad 17 × 6 µm , partim spinulosa, spinulae 1.5–3.5 × 1µm. CAULOCYSTIDIA *15–150 × 8–20 µm, versiformia, clavata vel vesiculosa, cylindrica, sphaeropedunculata vel contorta, confertim spinulosa, spinulae ad 1.5 × 1 µm.* SEPTA HYPHARUM *fibulata. Lignicola, in sylvis, Australia Occidentalis.*

Holotypus *in herbarium PERTH; Western Australia, Perth, Bold Park, (31°56'31.2"S 115 °46'43.8"E), 11.VI.2008, N.L. Bougher & E. Davison BOUGHER432.*

ETYMOLOGY: 'judithiana' is named after Judith Margaret Bougher (1927–2008).

MACROCHARACTERS — PILEUS 1–3 (6) mm diam., thin-fleshed, hemispherical then broadly campanulate to convex with an irregularly crenate, obscurely translucent-striate, thin margin covered with minute granules including some scattered projecting stalked granules (visible under magnifying lens), white, unchanging with age or attaining a pale grey tinge near center, not bruising. Pileal margin separates from stipe after elongation of the stipe has been completed. Surface dry, persistently granulose — entirely and densely covered by minute white granules in continuous irregular floccose piles. Granules less often forming collapsing, conic, pyramidal or tapering and curved piles of white granules up to 0.2 mm tall. LAMELLAE adnexed, without a pseudocollarium, white at first then cream, ventricose, subdistant, edge white, fringed, glistening, also with granules where near to pileal margin of young specimens, no anastomoses, one lamellulae between most pairs of lamellae, L= 8–9, l = 6–8,

each lamellulae, ventricose and less than half the height and length of the lamellae. Stipe 5–35 × 0.3–1.0 mm, central, slightly tapering towards apex, solid, base unswollen and not inserted in substrate, coherent basal disc absent but base usually with some sparse short white hairs appressed on substrate. Surface dry, with abundant finger-like, round-topped, erect, white cystidia up to 0.1 mm tall, each separated from each other, these easily removed and therefore may be sparse or absent in some specimens particularly when very wet, base of stipe with a short sleeve (0.5–1 mm) of piles of granules similar to those on the pileus. Overall colour white but dull cream when granules and cystidia are sparse revealing the background of the stipe, drying white. Odour not distinctive. Taste mild. Spore deposit white.

Microcharacters — Basidiospores (6.9) 7.1–7.8 (7.9) × (6.5) 6.7–7.4 µm, mean profile 7.45 × 6.94 µm, mean face view 7.31 × 6.91 µm, mean L/B ratio profile 1.07, mean L/B ratio face view 1.05 (n = 30). Hyaline in 3% KOH or water, weakly amyloid. Subglobose, globose, slightly asymmetrical in profile, smooth, thin-walled. Basidia 19–31 × 5–11 µm, clavate to broadly clavate with stalk 4–5 × 2.5–3.5 µm, hyaline, thin-walled, sterigmata to 6 µm in length, 4-spored, clamp connection at base, soon collapsing. Basidia do not mature before the pileal margin expands away from the stipe. Lamellae trama tightly packed, parallel, clamped hyphae 2.5–3.5 µm broad, strongly dextrinoid, oeliferous hyphae absent. Subhymenium hyphae similar to trama. Pleurocystidia absent. Cheilocystidia abundant, crowded, 18–32 × 9–19 µm, slender or broadly clavate, obpyriform, sphaeropedunculate, vesiculose, with narrow stalk 2.5–5.5 × up to 20 µm , thin-walled, hyaline, clamped at base, densely spinulose except smooth in lower part, spinulae of uniform size up to 0.8 µm tall × 0.3 µm wide at base, obtuse. Pileipellis a hymeniderm when very young then a cutis of thin-walled, sometimes spinulose, dextrinoid, clamped elements 6–16 µm broad, giving rise to prostrate and erect acanthocysts. Cherocytes also scattered on pileipellis. Acanthocysts and cherocytes disarticulating. Acanthocysts abundant, sometimes detached, 15–32 × 9–19 µm, globose, obpyriform, vesiculose, sphaeropedunculate, thin-walled, hyaline to pale grayish in KOH or water, dextrinoid, entirely densely spinulose, spinulae bluntly conic, obtuse, up to 1.5 µm tall × 1 µm wide at base. Cherocytes variable in size and form: 9–32 × 9–19 µm, globose, obpyriform, vesiculose, irregular. Terminals and often subtending elements sometimes thick-walled (up to 2.4 µm), with erect or curved thorn-like spines up to 17 µm long × 6 µm wide at base present usually on only part of each element either densely so or scattered. Elements also are often spinulose at least in part with spinulae 1.5–3.5 µm long × 1µm wide at base. Hyaline in KOH or water, dextrinoid. Cherocytes sometimes catenulate in chains of irregular elements and short hyphae 2–10 µm broad. Others form a globose terminal 21–32 µm diameter arising from an erect,

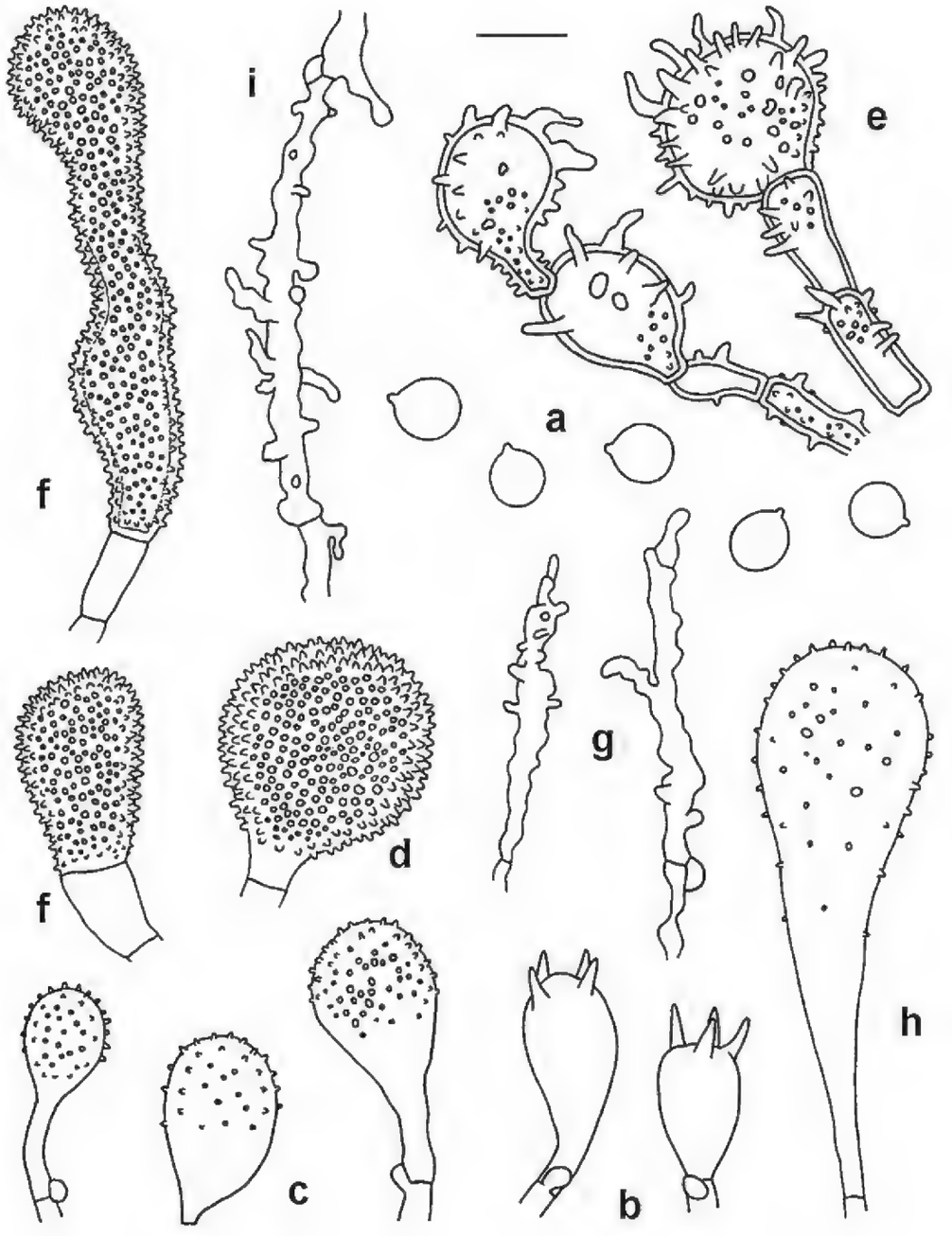

FIGURE 2. Micromorphology of *Mycena judithiana*: a–g Holotype. h, i BOUGHER505 a. Basidiospores. b. Basidia. c. Cheilocystidia. d. Pileal acanthocyst. e. Cherocytes. f. Caulocystidia.g. Cystidia from base of the stipe. h. An acanthocyst from base of the stipe. i. A knobby hypha from the stipe.
Scale bar: = 10 μm.

narrow (2–6 μm broad), smooth-walled or ornamented stalk or chain of elements that projects the terminal cell beyond the pileipellis (FIGURE 2e). Clamps not observed. HYPODERMIUM of thin-walled, smooth, dextrinoid hyphae, swollen up to 150 × 65 μm. PILEAL TRAMA a narrow layer of hyphae similar to hypodermium.

Stipe tissue monomitic, parallel, smooth, thin-walled, clamped hyphae, 3.5–4.5µm broad near surface, wider in interior (up to 15 µm broad), hyaline in KOH or water, dextrinoid. Some hyphae at the surface or in cortex with short, narrow, knobby protuberances and branches (Figure 2i). Caulocystidia abundant on majority of the stipe, some in loose fascicles, 15–150 × 8–20 µm, variable in shape: short forms clavate or vesiculose, longer forms cylindrical, sphaeropedunculate or contorted, with narrow smooth or spinulose stalk 3.5–4.5 µm curving outwards from the parallel hyphae of the stipe, thin-walled except sometimes basally thick-walled up to 1 µm broad, entirely densely spinulose, spinulae of uniform size up to 1.5 µm tall × 1 µm wide at base, conic to obtuse. Hyaline in KOH or water, dextrinoid. No clamps seen at basal septum, but present on next septum. Cystidia at extreme base of stipe contorted, branched, nodulose, thin-walled, up to 80 × 12 µm, hyaline in KOH or water, clamped. Some narrow, tapering hairs, 40–50 × 1.5–2 µm, with minor nodulations, and numerous slender to broadly clavate, sparsely ornamented acanthocysts also present. Detached acanthocysts and cherocytes often present. Clamp connections observed in the pileipellis, lamellae and stipe.

Ecology, range, disribution — Fruiting sparsely but can be spread over many meters on moist, rotting bark and wood of *Banksia* and *Eucalyptus*. On log or in shaded position amid litter on ground in south-west Australia. June-July. Uncommon or overlooked; only 3 collections known.

> Specimens examined—**AUSTRALIA. Western Australia: Perth** bold park (31°56'31.2"S 115 °46'43.8"E) — on inside surface of bark of fallen rotting banksia in eucalypt woodland, 11.VI.2008, coll. *N.L. Bougher & E. Davison BOUGHER432* – **holotype** here designated (PERTH). **Shire of Augusta** leeuwin-naturaliste national park, west bay bushland reserve 14779 (34°17'14.3"S 115°09'00.3"E)—on bark of fallen rotting marri (*Corymbia calophylla*) log in eucalypt woodland, 29.VI.2008, coll. *N.L. Bougher & A. Dyson BOUGHER454* (PERTH). **Shire of Augusta** leeuwin-naturaliste national park, west bay bushland reserve 14779 (34°17'13.6"S 115 °09'01.1"E)—on bark of fallen rotting marri (*Corymbia calophylla*) from log in eucalypt woodland incubated in laboratory for 25 days, 25.VII.2008, coll. *N.L. Bougher BOUGHER505* (PERTH).

Comments — The granulose pileus of *Mycena judithiana* distinguishes it and other members of *Mycena* section *Sacchariferae* from the many other superficially similar species of *Mycena* that produce minute white basidiomes on wood or litter in eucalypt-dominated ecosystems and elsewhere. Under a hand lens it may be possible to discern the finger-like caulocystidia of *M. judithiana* and thereby distinguish it from species of *Mycena* such as *M. tenerrima* that have hirsute, pruinose or smooth stipes. Some caution may be required, however, because the caulocystidia of *M. judithiana* appear plump on basidiomes growing in moist situations, but in drier conditions the caulocystidia can become narrower and contorted.

The basidiomes of *M. judithiana* are thin-fleshed and can rapidly shrivel up upon change in moisture or humidity. When they are placed in water, air-dried specimens immediately expand, although they remain somewhat contorted and never fully return to their former pristine shape. This indicates that basidiomes of *M. judithiana* have the capacity to revive in a way similar to that noted by Horak (1980) for *Mycena spinosissima* (Singer) Desjardin, another species of section *Sacchariferae*.

Taxonomic relationships of *Mycena judithiana* — The presence of some thick-walled elements with large projections in *M. judithiana* herein interpreted as cherocytes suggests alignment of this species with the stirps *Amparoina*. This stirps was proposed by Desjardin (1995) to accommodate about one third of known species of *Mycena* section *Sacchariferae* having a universal veil composed of disarticulating acanthocysts and cherocytes. A wide morphological range of thick-walled elements are accepted as cherocytes in *Mycena* species by Desjardin (1995), including forms similar to those occurring in *M. judithiana*.

Spore shape separates *M. judithiana* from the majority of species of *Mycena* section *Sacchariferae* which have ellipsoidal, oblong or pip-shaped spores. The spores of *M. judithiana* are predominantly subglobose and globose with a mean length/breadth ratio 1.07 in profile, and 1.05 in face view. None of the six species of *Mycena* section *Sacchariferae* described for Australia by Grgurinovic (2003) have subglobose spores. Nor do any of the eight species accepted in stirps *Amparoina* by Desjardin (1995). One of the eight species, *M. trichocephala* Singer, has been recently ejected and allied to section *Longisetae* by Desjardin et al. (2002). Three species of *Mycena* section *Sacchariferae* with subglobose spores but not placed within stirps *Amparoina* by Desjardin (1995) are *M. corynephora* Maas Geest., *M. yalensis* Singer, and *M. pulvinibasis* Desjardin. *M. corynephora* from Europe is similar to *M. judithiana* in having short and long caulocystidia and a habit on bark (in its case on *Aesculus*), but differs by having larger spores (mean 8.5 × 7.6 μm). *M. pulvinibasis* from Madagascar differs from *M. judithiana* by lacking caulocystidia., *M. yalensis* from Argentina is perhaps the closest species to *M. judithiana* as it has short and long caulocystidia, relatively small subglobose spores (mean 7.1 × 6.1 μm), and a habit on bark (in its case on *Alnus*). However, *M. yalensis* does not have cherocytes and is placed in stirps *Alphitophora* (Desjardin 1995).

Basidiome development of *Mycena judithiana* — Successive basidiomes produced during incubation in humid chambers enabled the development of the pileus and stipe and their surface structures to be tracked. For the first 3 weeks of incubation, many new fully formed and expanded basidiomes of *M. judithiana* were produced on wood fragments. After that period an increasing number of basidiomes produced a typically long stipe but their pilei

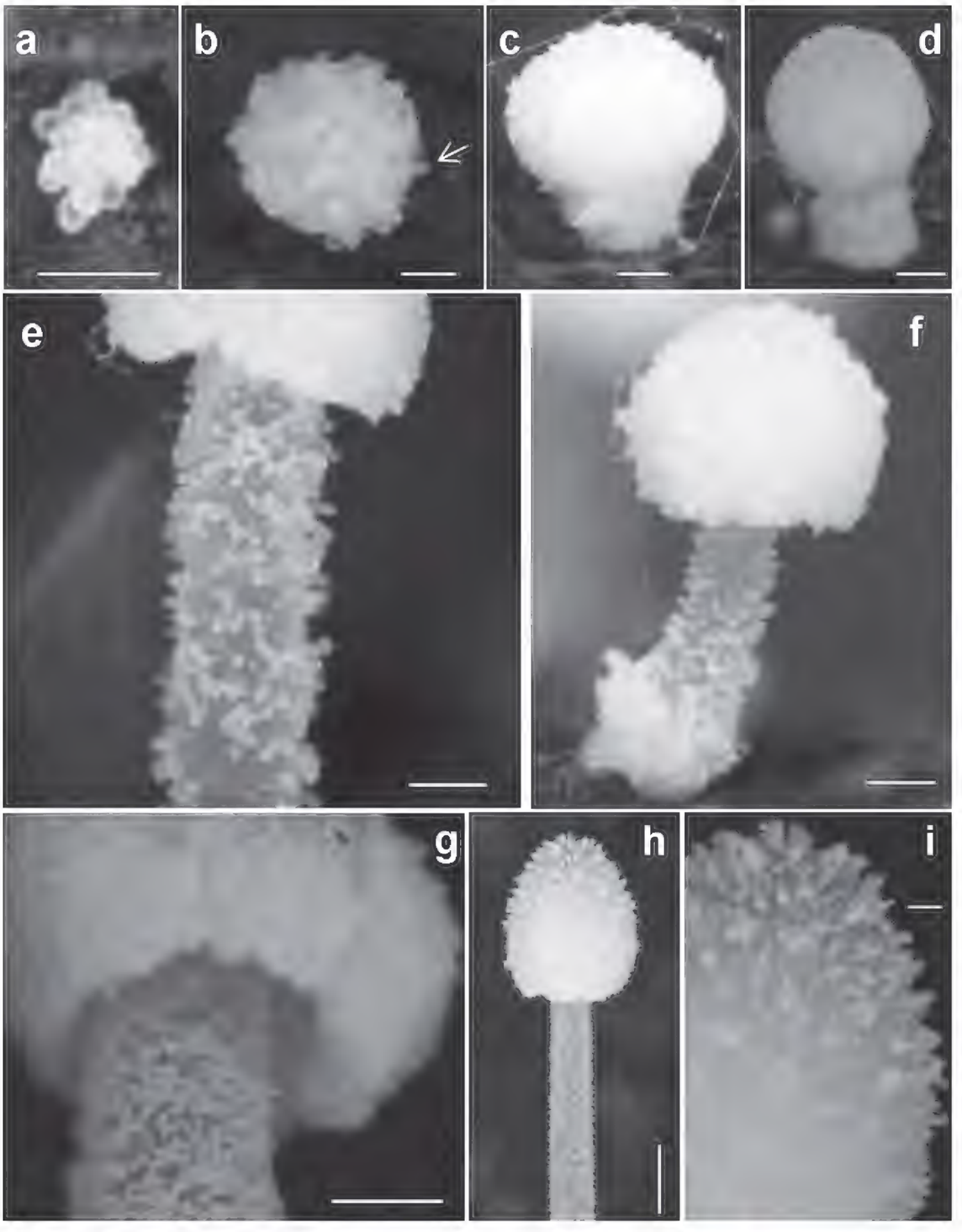

FIGURE 3. Basidiome development of *Mycena judithiana*: a, h, i BOUGHER454; b–g Holotype. a. Stage 1 (top view) – a recently initiated primordium appearing as a minute bundle of globose granules. b. Stage 2 (top view) – a more compact primordium, with some globose granules projecting beyond the surface (arrow). c. Stage 3 (side view) – a primordium with obpyriform shape and entirely covered with granules. d. Stage 4 (side view) – a primordium outwardly displaying a distinct stipe and pileus for the first time. e. Stage 5 (side view) – a rapidly elongating stipe now free of granules and with abundant acanthophysoid caulocystidia exposed. f. Stage 5 (side view) – a dense covering of granules remaining on the pileus and at the base of the stipe. g. Stage 5 (side view) – a crenate pileus margin clasping near to the stipe. h. Stage 6 (side view) – an ovoid,

remained unopened—perhaps due to exhaustion of the limited resources of the incubated wood fragments. Basidiomes of *M. judithiana* that were produced for the first time after 25 days incubation on the wood fragment from which *Mycena tenerrima* had been fruiting were fully expanding. That particular wood fragment was larger than fragments on which the other collections had been fruiting, perhaps providing greater resources to the fungus.

Observations on variously-aged basidiomes showed that *M. judithiana* has a diphasic mode of development. As outlined by Corner (1994) for *Mycena*, the diphasic mode is whereby the whole basidiome is grown within an unexpanded hemispherical primordium, followed by extension of the stipe, and then by expansion of the pileus. Corner (1994) determined that this mode of development is most pronounced in *Mycena* section *Basipedes* and perhaps also in section *Sacchariferae*. Kühner (1938) examined the diphasic basidiome development of one species of *Sacchariferae—Mycena tenerrima*. Stages 1 to 6 as defined below for *M. judithiana* spans a period of approximately 4 to 5 days.

Stage 1 (fish eggs stage): The youngest primordia of less than about 120 µm in diameter consist of white globose granules aggregated into an irregular-shaped mass, resembling a bundle of minute fish eggs (Figure 3a).

Stage 2 (sessile hemispherical stage): More granules are produced to form a more compact, sessile, semi-hemispherical or cushion-shaped primordium approximately 0.25–0.4 mm in diameter (Figure 3b). A narrow, dense band of short hairs develops at the base of stage two primordia. The young primordia are soft, easily broken by touch, and readily removed from the substrate. Some of the granules appear to be stalked and project beyond the main layer of granules (as visible under magnifying lens). The granules of *M. judithiana* primordia (and also on mature basidiomes) are acanthocysts and cherocytes. Stalked, projecting granules are mostly cherocytes (see Figure 2e). At the early stages of development the primordia are composed almost entirely of acanthocysts and cherocytes, with a central core of tissue which begins developing into the pileus and stipe.

Stage 3 (pyriform stage): The primordia begin to extend vertically and transform into a squat obpyriform form approximately 0.5–1 mm in diameter (Figure 3c). The primordium is entirely covered by granules, and a band of basal hairs remains narrow and dense. During this stage a central core has differentiated into a vestigial pileus and stipe and has determined the obpyriform

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unexpanded pileus on a fully elongated stipe. i. Stage 6 (side view) – erect piles of granules on the pileal surface of a pristine basidiome (piles are also evident in Fig. 3h).

Scale bars: a, b = 0.1 mm; c, d = 0.3 mm; e, f, g = 0.4 mm; h = 1 mm; i = 0.2 mm.

shape of the primordium, but the pileus and stipe are not yet distinguishable in surface view.

Stage 4 (initial emergence of stipe and pileus): Upon further vertical elongation of the primordia, the pileus and stipe become outwardly distinguishable for the first time (Figure 3d). The pileus is now more or less globose and entirely covered by granules but has not increased in size from the previous stage. The pileus has been elevated by the stipe which is just about to begin its phase of rapid elongation. At this stage the stipe appears as a cylinder only about 0.1–0.4 mm tall and is entirely covered with overlapping, dense piles of granules. The stipe is still subtended by a basal band of short hairs which has so far remained intact but will usually begin to deteriorate from now onwards.

Stage 5 (rapid elongation of stipe): During the early elongation of the stipe, when it is only approximately 1–2 mm tall, its surface begins to attain its mature form. The stipe is now no longer covered by overlapping piles of granules, but reveals long, plump, often erect acanthocysts that are in loose fascicles and become increasingly separated from each other (Figure 3e). Near the base of the stipe a sleeve of dense, overlapping piles of granules persists (Figure 3f). These granules may reach all the way to the substrate depending upon the integrity of the basal band of short hairs. In most cases the hairs have by now become less densely arranged and mainly appressed to the substrate. The pileus gradually gains more width than height to attain a more ellipsoidal or hemispherical shape, but the pileal margin remains clasped near to the stipe while the phase of rapid elongation of the stipe continues. The clasped or slightly separated margin is crenate and covered with abundant piles of granules (Figure 3g).

Stage 6 (stipe elongated, pileus expands): The stipe elongates to its full length and at first has an unexpanded pileus (Figure 3h). Then after elongation of the stipe has been completed the pileus expands to its maximum size and the pileal margin separates from the stipe to expose the lamellae. As in earlier stages, the surface of the expanding pileus is covered with overlapping, dense piles of granules. In most specimens of *M. judithiana* the piles are irregular and sit mainly flat on the surface. However, in some pristine, larger specimens (e.g. with unopened pilei up to 2–2.5 mm tall) the granules may be arranged into conic, pyramidal or tapering and curved piles of white granules up to 0.2 mm tall (Figure 3i). These erect piles are not removable as an intact unit as they are very fragile and crumble upon any attempt to remove them. Macroscopically, and under a high powered lens, the granules comprising the erect piles of *M .judithiana* appear indistinguishable from the granules in the intervening areas and from those forming the flatter piles of granules more typical of this species. Granules in the both the erect piles and in the intervening flat areas

are composed of acanthocysts and cherocytes. The erect piles of *M. judithiana* rapidly disassociate and disappear after early stages of basidiome development, and there are rarely any such piles remaining at maturity. Some other species of *Mycena* section *Sacchariferae* such as *Mycena spinosissima* and *M. heteracantha* (Singer) Desjardin are known to have well developed conic to pyramidal pileal piles up to 2 mm tall (Horak 1980, Desjardin 1995, Takahashi 1999). The erect piles of *M .judithiana* are shorter and more variable than in those species.

During observations of primordial development it became evident that young primordia of *M. judithiana* were grazed upon heavily and often completely disassociated by collembolla and minute mite-like arthropods. The creatures were observed scattering granules by default around the vicinity of grazed basidiomes and sometimes transporting some granules as they crawled away. It is not known if the granules of *M. judithiana* could act as propagules, and if the wood-inhabiting arthropods provide another option for dispersal of this species. Acanthocysts and cherocytes of other species in *Mycena* section *Sacchariferae* have been shown to germinate on agar (Singer 1983, Desjardin 1995).

Mycena tenerrima (Berk.) Quél., Mém. Soc. Émul. Montbéliard, sér. 2, 5: 109 (1872), as *'tenerrimus'*. FIGS 4–5

= *Agaricus tenerrimus* Berk., in Engl. Fl. 5(2): 61 (1836).
≡ *Prunulus tenerrimus* (Berk.) Murrill, N. Amer. Flora 9: 322 (1916).
≡ *Pseudomycena tenerrima* (Berk.) Cejp, Publ. Fac. Sci. Univ. Charles 104: 151 (1930).
= *Agaricus farinellus* Feltgen, C.R. Soc. Natn. Luxemburg 16: 145 (1906).
≡ *Mycena farinella* (Feltgen) Sacc. & Trotter, Syll. Fung. 21 : 58 (1912).

MACROCHARACTERS — PILEUS 1–5 mm diam., thin-fleshed, sessile and cushion-shaped (hemispherical) at button stage, then convex, not usually becoming campanulate, with broadly flattened apex from which shallow radial grooves extend to the pileal margin, uniformly white to pale cream or sometimes slightly darker or dull at centre, not bruising, obscurely translucent-striate when moist. Margin thin, entire, incurved at first, not upturning with age, covered with granules some of which extend over the margin, wavy in older specimens. Surface dry, densely granulose when young with abundant, minute, white spherical granules not organized into raised piles, furfuraceous at maturity with scattered and sometimes inconsistent covering of granules. LAMELLAE shallow or broadly adnexed, pseudocollarium not well developed and sometimes may be absent white at first then cream, ventricose, subdistant, edge cystidiate and slightly paler than face, no anastomoses, one (mostly) to three lamellulae between pairs of lamellae, e.g. L= 18, l = 12, most lamellules less than half the height and length of the lamellae. STIPE 5–25 × 0.2–1.2 mm, central, equal or slightly tapering towards apex, solid becoming hollow, white

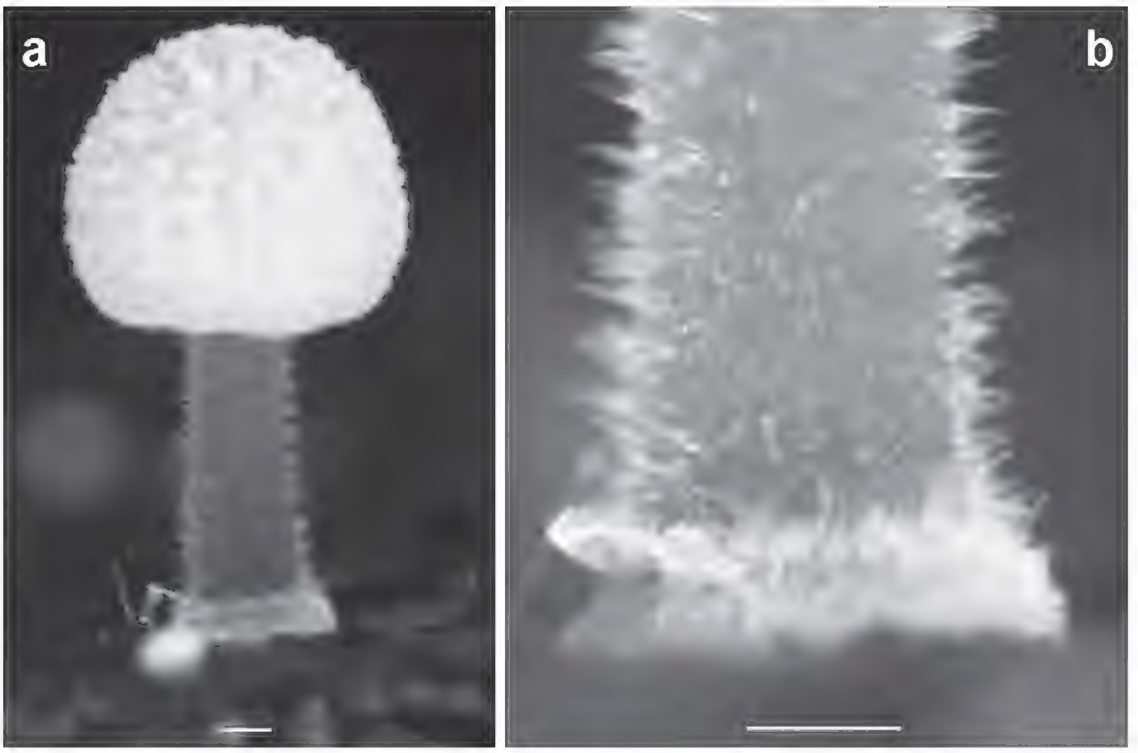

Figure 4. *Mycena tenerrima* (BOUGHER453): a. Granulose pileus, stipe with long, hair-like cystidia, and basal disc with dense, short hairs. b. Closer view of caulocystidia and stipe base. Compare and contrast with stipe of *M. judithiana* (Figs 3e, f, p. 166). Scale bars = 0.5 mm.

to dull grey especially in lower half, becoming semi-translucent when older, entirely covered with soft, white hairs when young, later the hairs may be less abundant in upper half of the stipe and eventually become scattered or disappear. Water droplet visible (with hand lens) at apex of many hairs in moist conditions. Base not inserted in substrate, slightly wider than the stipe with a compact, narrow collar approximately 0.5 mm wide of dense, short, erect, white hairs (Figure 4). Odour not distinctive. Taste mild. Spore deposit white.

Microcharacters — Basidiospores (7.5) 7.6–8.8 (9.0) × (4.4) 4.5–5.3 µm, mean profile 8.23 × 4.83 µm, mean face view 8.17 × 4.82 µm, mean L/B ratio profile 1.70, mean L/B ratio face view 1.69 (n = 30). Hyaline in 3% KOH or water, weakly amyloid. Ellipsoidal, pip-shaped, or oblong, asymmetrical in profile, smooth, thin-walled. Basidia 15–19 × 5–9 µm, clavate to broadly clavate with stalk 4–5 × 2.5–3.5 µm, hyaline, thin-walled, sterigmata to 6 µm in length, 2-spored, clamp connection at base, sterigmata up to 5 µm long. Lamellae trama clamped, hyphae swollen at maturity up to 20 µm broad. Subhymenium narrow layer of clamped hyphae 2–2.5 µm wide. Pleurocystidia absent. Cheilocystidia abundant, forming sterile gill edge, basal portion 12–32 × 5–12 µm, sometimes clavate to ventricose (when immature?), usually lageniform with a single, long, narrow, smooth-walled rostrum (less often two)

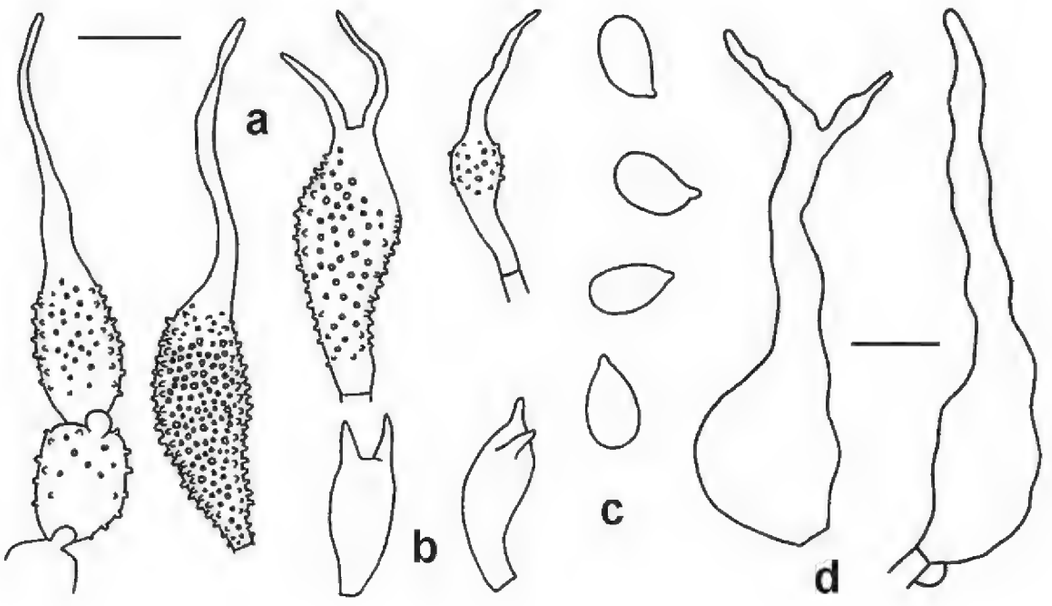

FIGURE 5. Micromorphology of *Mycena tenerrima* (BOUGHER453): a. Cheilocystidia. b. Basidia. c. Basidiospores. d. Caulocystidia. Scale bars: a–c = 10 µm; d = 10 µm.

up to 35 µm long. Entire basal portion and subtending cell densely spinulose or ornaments absent in lower part and subtending cell. PILEIPELLIS a cutis of clamped smooth-walled or spinulose hyphae 3–10 µm broad, with abundant terminal acanthocysts in palisade-like arrangement and subtended by short chains of ornamented cells in young basidiomes. Acanthocysts 10–36 × 10–26 µm, clavate to vesiculose, rarely with one or two apical projections, entirely covered with crowded, cylindric, obtuse spinules up to 2 × 1 µm. HYPODERMIUM of thin-walled, smooth, clamped, dextrinoid hyphae swollen up to 70 × 30 µm. PILEAL TRAMA a narrow layer of hyphae similar to hypodermium. STIPE TISSUE monomitic, parallel, smooth, thin-walled, clamped hyphae, 3.5–4.5 µm broad near surface, wider in interior (up to 15 µm broad), hyaline in KOH or water, dextrinoid. CAULOCYSTIDIA scattered singly or in small clusters, 50–110 × 6–18 µm, lanceolate to slender lageniform, smooth, thin-walled, hyaline in KOH or water, inamyloid, apex sometimes with two or more contorted, dendritic branches, clamped at base. Branched caulocystidia sometimes with a water droplet at the apex (visible with hand lens). CYSTIDIA OF BASAL DISC a dense palisade of variable elements including chains of ellipsoidal, globose and elongate cylindric cells 30–70 × 20–25 µm, and cylindric or tapering hair-like elements up to 120 × 3 µm. All elements smooth, thin-walled, clamped. No acanthocysts present in basal disc. CLAMP CONNECTIONS present in all tissues.

HABIT AND HABITAT — In Western Australia fruiting singly or gregariously on fallen twigs, branches and logs of *Eucalyptus* and other plants. April-July. Probably

common but overlooked in Australia. Known from 14 sites (15 collections) in eucalypt forests and woodlands in south-west Australia.

Representative Specimens examined — **AUSTRALIA. Western Australia: Shire of Augusta** leeuwin-naturaliste national park, west bay bushland reserve 14779 (34°17'13.6"S 115 °09'01.1"E)—on bark of fallen rotting marri (*Corymbia calophylla*) log in eucalypt woodland, 29.VI.2008, coll. *N.L. Bougher & A. Dyson BOUGHER453* (PERTH). **Sutton Forest Block** 2.1 km west of lockyer road on cripple road (34°29'42"S 116 °18'03"E)—in regenerated karri (*Eucalyptus diversicolor*) forest, 9.VI.1999, coll. *R.M. Robinson FF791* (PERTH). **Flybrook Forest Block** 500 m south of flybrook road on tank road (34°28'35"S 115 °51'20"E)—on twig of *Trymalium floribundum* in regenerated karri (*Eucalyptus diversicolor*) forest, 16.VII.2002, coll. *R.M. Robinson & R.H. Sutton 1617* (PERTH).

Comments — The Western Australian collections described above conform to *M. tenerrima* by having a combination of the following characters: (i) bisporic basidia; (ii) cheilocystidia with an ornamented swollen basal portion and often a smooth, long rostrum; (iii) abundant acanthocysts rendering the pileus densely granulose; (iv) smooth, slender caulocystidia; (v) basal disc comprised of variable cystidia, including some in chains; (vi) clamp connections present in all tissues. *Mycena tenerrima* var. *carpophila* J.E. Lange differs by having quadrisporic basidia and narrower spores (Desjardin 1995, Tanaka & Hongo 2003).

The mean spore size of the Western Australian specimens (profile 8.23 × 4.83 µm, face view 8.17 × 4.82 µm) is lower than Desjardin's (1995) data for *M. tenerrima* [as *Mycena adscendens* (Lasch) Maas Geest. var. *adscendens*] based mainly on North American collections (9.6 × 5.4 µm). However, the Western Australian spores [(7.5) 7.6–8.8 (9.0) × (4.4) 4.5–5.3 µm] partially overlap the size range attributed to *M. tenerrima* by Desjardin (1995): 8.3–10.2 (11.2) × (4.8) 5–6 (6.4) µm, and are also within the range (8–11 × 5–6 µm) considered by Desjardin as characteristic of this widespread taxon.

The spores of the Western Australian specimens are similar in size to those of several narrower-spored taxa that closely resemble *M. tenerrima*. The quadrisporic variety *M. tenerrima* var. *carpophila* has spores reported from Europe to be 4–4.5 µm wide (Desjardin 1995), and 3.6–4.8 µm wide from Japan (Tanaka & Hongo 2003). *Mycena nucicola* Huijsman from Europe has spores 4.2 – 5 µm wide, and *M. cryptomeriicola* Imazeki & Toki from Japan has spores 4 – 5 µm wide (Desjardin 1995). However, *M. nucicola* and *M. cryptomeriicola* differ from *M. tenerrima* by having quadrisporic basidia. The basal disc of *M. nucicola* is reported to have acanthocysts (Desjardin 1995), and this also separates it from *M. tenerrima* including the Western Australian specimens which do not have such acanthocysts. *Mycena cryptomeriicola* is also further separated from *M. tenerrima* by having inamyloid spores, no clamp connections, and a habit on coniferous leaves (Maas Geesteranus 1991, Desjardin 1995, Tanaka & Hongo 2003).

Comparison of the two species — *M. judithiana* and *M. tenerrima* are not easily distinguished from each other with the unaided eye. Their similarity is emphasized in circumstances where the species co-occur. The two species can fruit in extremely close proximity. In the current study, fully matured basidiomes of both species simultaneously occurred within 10 mm of each other on a piece of bark only 5 × 2 cm × 5 mm thick. Because of their superficial similarity in the field and the possibility of their close co-occurrence, at least in Western Australia, mixed collections are a distinct possibility. However, these species can be distinguished in the field by using a hand lens to observe the plump caulocystidia of *M. judithiana* that are distinguishable from the hair-like caulocystidia of *M. tenerrima* (compare Figures 3e, f and 4a, b). In drier conditions, the caulocystidia of *M. judithiana* can appear narrower and contorted but are still distinguishable from the soft hairs of *M. tenerrima*. The base of the stipe also distinguishes these species. *M. judithiana* has a non-flaring sleeve of white granules similar to those of its cap surface, while *M. tenerrima* has a flaring collar of dense short hairs. However, in both species the hairs or granules on the base can become disorganized and less distinct in older or water soaked specimens. Microscopically *M. judithiana* and *M. tenerrima* are distinguishable by: (i) subglobose to globose spores of *M. judithiana* compared with the ellipsoidal spores of *M. tenerrima*; (ii) acanthophysoid caulocystidia versus smooth-walled, slender caulocystidia in *M. tenerrima*; (iii) thorny cherocytes present only in *M. judithiana*; (iv) acanthocysts present at the base of the stipe in *M. judithiana* but absent in *M. tenerrima* which has a palisade of variable cystidia including some in chains in the basal disc.

Acknowledgments

Part of this research was facilitated by the Perth Urban Bushland Fungi Project – financially supported by Lotterywest, and facilitated by the Western Australian Naturalists' Club and Urban Bushland Council in conjunction with the Department of Environment and Conservation's (DEC) Western Australian Herbarium. DEC staff Julie Fielder and Richard Robinson are thanked for forwarding collections of their "tiny white scaly cap" from DEC's forest monitoring program Forestcheck which turned out to be *M. tenerrima*. The author wishes to thank Dr Dennis Desjardin, San Francisco State University, and Dr Cheryl Grgurinovic, Australian Quarantine and Inspection Service, for critically reviewing this manuscript. Paul Wilson, Western Australian Herbarium, is thanked for checking the Latin description.

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